

THAT WHICH IS CLAIMED IS:

1. A method for analyzing matter comprising the steps of:

(a) introducing a liquid or gaseous matter into an optically reflective thin layer electrode, the electrode including a transparent base substrate with alumina film disposed thereon, the alumina film defining a plurality of pores therein, and a gold film disposed on the alumina film such that a quantity of the liquid or gaseous matter can enter at least one of the pores;

(b) applying a potential to the gold film such that the quantity of the liquid or gaseous matter in the pores is isolated from a remaining bulk of the liquid or gaseous matter disposed about the electrode; and

(c) directing light from a source into the electrode from proximate the base substrate in a direction of the gold film, the gold film under the potential configured to reflect the light into the quantity of the liquid or gaseous matter in the pores for analysis of the reflected light.

2. The method as in Claim 1, wherein the liquid or gaseous matter is selected from the group consisting of potassium ferricyanide, sodium sulfate, water and solutions thereof.

3. The method as in Claim 2, wherein the liquid or gaseous matter is a solution of 0.01M ferricyanide, 0.05M sodium sulfate, and deionized water.

4. The method as in Claim 1, wherein the transparent base substrate is made of glass.

5. The method as in Claim 1, wherein the applied potential is between +0.4V to -1.5V.

6. The method as in Claim 1, further comprising the step of holding the potential for 200 seconds to 400 seconds.

7. The method as in Claim 1, further comprising the step of directing the light from the source at the base substrate at about a 45° angle.

8. The method as in Claim 1, further comprising the step of monitoring the reflected light in the quantity of the liquid or gaseous matter isolated in the pores by reflectance spectroscopy.

9. The method as in Claim 1, further comprising the step of taking specular reflectance measurements by a detector disposed at about 90° to the reflected light.

10. An optically reflective thin layer, comprising:

a transparent base substrate;

a film disposed on the base substrate, the film defining a plurality of pores therein; and

5 a reflective material disposed on the film such that the pores are exposed to atmosphere, the reflective material having a specular surface for reflection of light into the pores for taking measurements of a fluid isolated therein from the atmosphere.

11. The optically reflective thin layer as in Claim 10, wherein the transparent base substrate is glass.

12. The optically reflective thin layer as in Claim 10, wherein the pores are from 80 nm to about 100 nm in diameter and define a depth from 250 nm to about 1000 nm, the pores configured to hold a quantity of fluid when the optically reflective thin layer is immersed therein.

13. The optically reflective thin layer as in Claim 12, wherein the fluid is selected from the group consisting of a ferricyanide, a sodium sulfate, a water, a gas, and combinations thereof.

14. The optically reflective thin layer as in Claim 10, wherein the reflective material is a specular gold film configured to reflect a light beam that has been transmitted from a direction of the base substrate into the quantity of fluid disposed in the pores.

15. The optically reflective thin layer as in Claim 14, wherein the quantity of fluid in the pores is monitorable by specular reflectance spectroscopy, spectroelectrochemical analysis, interferometric analysis or combinations thereof.

16. A thin layer electrode disposed in a fluid in an atmosphere, the thin layer film comprising:

a transparent base substrate;

a thin film disposed on the base substrate, the thin film defining a

5 plurality of pores therein; and

a material disposed on the thin film such that the pores are exposed to atmosphere, the material configured to isolate a portion of the fluid in the pores from the atmosphere when a potential is applied, the material further configured for reflectance when the potential is applied to redirect into the
10 pores an incident beam passing through the transparent base substrate into the pores in a direction of the material.

17. The thin layer electrode as in Claim 16, wherein the transparent base substrate is glass.

18. The thin layer electrode as in Claim 17, wherein the thin film is alumina exhibiting a depth of 250 nm to 1000 nm.

19. The thin layer electrode as in Claim 16, wherein the material is a gold layer having a nanostructured face disposed away from the thin film and

configured to filter scatter-causing particles suspended in the liquid or gaseous matter.

20. The thin layer electrode as in Claim 16, wherein the fluid is selected from the group consisting of a ferricyanide, a sodium sulfate, a water, a gas, and combinations thereof.

21. A thin layer apparatus for fluid analysis, the thin layer apparatus comprising:

a transparent base substrate; and

5 a thin film sputtered on the base substrate, the thin film defining a plurality of pores therein, each of the pores having a diameter of 80 nm to about 100 nm and a depth of 250 nm to about 1000 nm, the pores configured to isolate a portion of a fluid from a remainder of the fluid when immersed therein.

22. The thin layer apparatus as in Claim 21, further comprising a material disposed on the thin film such that the pores are in communication with the fluid, the material having a specular surface to reflect into the pores an incident beam entering the pores through the transparent base substrate in a
5 direction of the material.